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ABSTRACT

Reinforcement for academic performance has been shown to increase both correct academic responding and rates of on-task behavior. Reinforcement for attending and on-task behavior has failed to increase correct academic responding in many studies, but it has produced vicarious and sociometric changes. The occurrence of vicarious and sociometric effects with academic contingencies was investigaged. Subjects were normal fourth-grade students with mild classroom behavior and math performance problems. One child in each of three pairs of students was reinforced for correct completion of math problems. Both treated and untreated children were observed to determine whether academic performance, classroom behavior, and sociometric status improved with treatment. Only the performance and behavior of treated children improved. Untreated children failed to improve substantially in math performance and actually deteriorated in on-task behavior. Sociometric status remained unchanged for all children. (Author)

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EFFECTS AND NONEFFECTS OF REINFORCEMENT FOR ACADEMIC PERFORMANCE

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EFFECTS AND NONEFFECTS OF REINFORCEMENT FOR ACADEMIC PERFORMANCE

The experimental study of the effects of reinforcement on academic performance is not a new area of enquiry. However, strong criticism of the target behaviors usually chosen by classroom behavior modifiers and a call for experimental examination (Winnett & Winkler, 1972; Reviewer's Comments, 1972) appears to have led to a renewed interest in the effects and side effects of reinforcement for academic performance.

Studies generated in the wake of this interest have shown that academic contingencies often lead to increases in both academic performance and on task behavior (Ayllon, Layman, & Burke, 1972; Ayllon, Layman, & Kandel, 1975; Ayllon & Roberts, 1974; Broughton & Lahey, in press; Hay, Hay, & Nelson, 1977; Kirby & Shields, 1972), whereas reinforcement for on-task behavior typically increases only on-task behavior (Hay, Hay, & Nelson, 1977). Studies of academic contingencies also have produced performance and behavioral effects that persisted when treatment was withdrawn (Broughton & Lahey, in press; Hay, Hay, & Nelson, 1977; Kirby & Shields, 1972), while treatment effects of behavioral contingencies have been lost when contingencies were removed (Hay, Hay, & Nelson, 1977). These results have led many practitioners to favor acadmeic contingencies over behavioral contingencies, even though they have failed to be obtained on some occasions (Ferritor, Buckholdt, Hamblin, & Smith, 1972).

There are positive aspects to intervention strategies which target social and on-task behaviors for modification, however. Positive behavioral effects have been found to spread vicariously to other children in the classroom who are not receiving treatment when the behavior of a particularly dis-

ruptive child is modified (Drabman & Lahey, 1974; Kazdin, 1973). Additionally, the sociometric status of disruptive children has been found to improve with modification of their inappropriate behavior (Drabman & Lahey, 1974; Drabman, Spitalnik, & Spitalnik, 1974).

Although research indicates that academic contingencies are more efficient than behavioral contingencies in producing changes in both classroom deportment and academic performance, no studies have determined whether the positive aspects of behavioral contingencies, positive vicarious effects and improved sociometric status, apply to academic contingencies. If positive vicarious and sociometric effects are obtained with academic contingencies, the argument for their use will be strengthened. If, however, these effects do not result with the use of academic contingencies, then behavioral contingencies will remain a viable intervention strategy when such effects are desired.

The purpose of this study was to determine whether reinforcement for accurate math performance among target children would produce positive vicarious academic and/or behavioral changes in nontarget children, and whether the sociometric status in the class of either target or nontarget children would change as a result of treatment.

METHOD

Subjects

Six pupils selected form a fourth-grade classroom served as subjects. The children were selected on the basis of three criteria: (1) low levels of correct math performance, (2) low levels of on-task behavior, and (3) sociometric ratings indicating that they were not highly regarded as friends or playmates by their classmates.

Setting and Materials

The children remained in their regular classroom. Desks were arranged into five modules of four desks each with one module in each corner of the room and one in the center. The subjects were randomly separated into pairs and seated side by side in each of three of the corner modules.

Observations were conducted each day for six weeks during the afternoon math period. During this period the children were given a worksheet of 20 math problems to work within ten minutes. All problems on the worksheet were two digit x three digit vertical multiplication problems and were constructed by selecting five single digit numbers from a random numbers table for each problem. All worksheets throughout the study were formed in this manner.

Dependent Measures and Observation Procedures

Percent correct. The daily percentage of problems completed correctly by each subject served as a direct measure of the effectiveness of the academic reinforcement procedure. This measure was obtained from the teacher's scoring of each worksheet and consisted of the number of correctly worked problems divided by the number of problems attempted. A problem was considered attempted if any markings were visible in the space designated for the answer. Percent correct was computed by this formula because the children's primary deficit was accuracy rather than rate. Typically, they rushed through the problems, completing most incorrectly. Reliabilities for this measure were computed by the exact agreement method (number of agreements/number of disagreements plus agreements x 100) by masking the teacher's marks and randomly rescoring three of the papers each day.

Percent on-task. The amount of on-task behavior exhibited by each

subject during the math period was employed as a collateral measure of the effectiveness of the academic performance contingency. Observations were made using a 20 second observe - 10 second record time-sampling procedure. Each child was observed for five intervals per period in a predesignated sequence. Following each interval the child being observed was rated as being either on-task or off-task. To be rated as on-task, the child had to be in his seat, looking at or writing on his worksheet, counting silently or on his fingers, or talking with the teacher for the entire 20 second interval. Children were rated as off-task who left their seats, spoke without permission, touched another child or his material, or created an audible, distracting noise at anytime during the interval. A child was also rated as off-task if he failed to look at or write on his worksheet for the entire interval.

Three observers were employed during the study. One observer was present each day, and a second observer was present for 35% of the sessions to assess reliability. Occurrence reliabilities were computed for the on-task measure by the exact agreement method. Nonoccurrence reliabilities also were assessed for the off-task measure.

Sociometric data. Five times during the study, students in the class were asked to complete a set of questions indicating the sociometric structure of the class. The questions were modifications of those employed by Drabman & Lahey (1974). Three questions were administered during each sociometric rating and read:

(1) If you were an astronaut, and you were going on a long, long trip to the moon, who would you want to take along? Remember to choose only one person that you would want to be with for a long time; a person you could get along with very well.

(2) You are doing a hard job and you need someone who is responsible and grown-up; who would you pick? Remember to pick only one person and to pick a person who is grown-up and will do a good job.

(3) If I asked you to help me pick a person to receive today's happy face award, who would you pick? Remember to pick only one person and pick a very deserving person.

The children indicated their choices by writing the name of the person they selected after each question was read. They were free to choose anyone in the class, and they could indicate the same person more than once. Following each rating, each child was assigned a score consisting of the combined total of choices he received on the three questions. Since absentees caused the number of children in the class to vary from day to day, the total score was converted to a proportion by dividing by the number of children participating in the rating procedure.

Procedure

One child from each pair of subjects was chosen randomly to be a target for treatment. The remaining child in each pair was designated as a nontarget child. The two children in each module were seated next to each other so that the nontarget child could observe the target child receiving treatment and hear the comments directed to the target child by the teacher.

Treatment effects were assessed within a multiple-baseline design, with each pair of children being brought under treatment sequentially. Conditions presented during the study were:

Baseline. During this phase the children were given their daily math worksheets and instructed to work on them for ten minutes. The teacher was

instructed to conduct this phase the way she normally held seatwork sessions. This consisted of remaining at her desk to complete her own work, occasionally looking up to survey the class and instruct disruptive or procrastinating pupils to work.

Treatment. During the treatment phase for each subject pair, the children were given their worksheets and allowed to work for ten minutes as during baseline. The teacher circulated around the room as the children worked, attending only to the child or children specifically designated to receive treatment. In addition to the instruction to attend to target children receiving treatment approximately every two minutes, the teacher was given the following written instructions:

(1) Continue not to interact with children not designated to receive treatment in any special way (maintain baseline conditions for nontreatment children).

(2) Praise treatment children by name (e.g., "Jane, you got this one right!").

(3) Attend only to correctly completed work and not to on-task behavior per se, or to off-task behavior (e.g., "Good for you, Bob, you remembered to carry and you've gotten three right!", not, "Bob, I like the way you are working.")

(4) Stand between the children in each pair when attending to the target child so the non-target child will be sure to hear.

(5) Speak at a loudness level sufficient for the nontarget child of each pair to hear, but not loud enough for either of the other two pairs to hear.

In addition to praise and attention for correct responses, the teacher

placed a checkmark under each correct problems as she praised the work. The teacher was given an answer key each day to carry with her to facilitate scoring and selection of work for praise.

RESULTS

Reliabilities. Reliabilities were computed for the percent correct measure by randomly selecting three of the children's papers each day and having them rescored by a second scorer. The second scoring was completed by calculator, and all previous marks were masked. An exact agreement score of 100% was obtained for all papers rescored.

Exact agreement scores were assessed for the on-task measure on 35% of the sessions distributed throughout the study. Mean agreement between the observers was 89% with a range of 69% too 100%. Agreement scores for off-task behavior ranged from 64% to 100% with a mean of 85% agreement.

Reliabilities for rate of teacher attention were also assessed on 35% of the sessions. Average reliability for teacher attention was 92% with a range of 66% to 100% agreement.

Teacher attention. Examination of Table 1 shows that the teacher complied with her instructions. Little or no attention was directed toward the children during baseline. Only target children received attention during treatment at the rate of approximately one contact every 1.6 minutes.

Percent correct. Figure 1 presents the percent correct math performance of the children during baseline and treatment. Target children showed immediate improvement in their performance upon implementation of the attention contingency. Nontarget children showed no departure from their baseline trends.

Percent on-task. Implementation of reinforcement was associated with increased on-task behavior in the target children as indicated in Figure 2. Daily results for individual children were variable, but all children followed

the pattern shown in Figure 2. Nontarget children decreased on-task behavior during the course of the study.

Sociometric data. The number of choices received by each child on the sociometric questions was pooled to yield a total score for each child on each administration of the questions. Table 2 shows the mean proportion of children in the class choosing a target or nontarget child during baseline and treatment. As can be seen, the sociometric status of the children did not vary systematically between conditions. Examination of the nontarget children's preferences revealed no greater tendency to choose their paired target child from baseline to treatment. Target children tended to receive higher scores during both phases of the study. Two target children and one nontarget child obtained their highest ratings during the treatment phase, but they were small increases and were not maintained when future ratings were made.

DISCUSSION

The results of this study replicated earlier research which has shown that the implementation of academic performance contingencies produces improvements in both academic performance and on-task behavior. The academic contingency provided in this study did not lead to vicarious academic or behavioral effects in nontarget children, however. Nontarget children, though showing gradual improvement in math performance over the six weeks of the study, failed to show clear treatment effects. They also decreased in on-task behavior over the course of the study. Additionally, sociometric ratings did not vary systematically from baseline to treatment.

It appears from the results of this study that vicarious and sociometric effects may not be common by-products of otherwise effective academic contingencies. However, a recent study (Aaron & Bostow, 1978) reported increases in the productivity of nontarget children when an academic contingency was

introduced. These conflicting results indicate further research will be required to determine the specific conditions under which vicarious effects may or may not be expected from academic contingencies.

Examination of prodecural differences between these two studies may shed light on the relevant variables. In the study by Aaron and Bostow, free-time was employed as the reinforcer. The granting of free-time is a more intrusive procedure than praise, which may have served to call the nontarget children's attention to the fact that target children were receiving preferential treatment contingent on certain behaviors, which they then imitated. Perhaps programs employing free-time activities, tokens, or where target children are praised before the class will be more likely to produce vicarious effects. In this study, praise was administered so that only the children at the module with a treated target child would be aware of it. This was done to preserve the integrity of the multiple baseline design across subjects in the event vicarious effects were obtained.

A second difference between the two studies was that three children out of a class of eight were brought under the more intrusive procedure at once in the Aaron and Bostow study. Perhaps the probability of vicarious effects with academic contingencies increases with the number of treated children.

Several other variables related to the present study might be important. The contingency program in the present study was in effect only during the math period. A more extensive contingency management program might be required to produce vicarious and sociometric effects, since improvement in one subject or during one period might not be sufficient. In the Aaron and Bostow study, contingencies were in effect over several activity periods. Additional variables which could be influential might be reinforcement schedule,

whether the academic skill being reinforced is mastered or near mastery by nontarget children, and whether the nontarget child is the same or different sex as the target child.

The measure of sociometric status in the present study could be too weak to detect specific changes resulting from the contingencies. Perhaps observations of the number and nature of interactions of the target and nontarget children should be employed instead of or in addition to sociometric ratings.

In summary, the results obtained by this study indicate that vicarious and sociometric effects do not necessarily follow from the employment of academic contingencies. A number of questions remain concerning conditions under which these effects may or may not be obtained.

TABLE 1

MEAN RATES OF CONTINGENT PRAISE FOR CORRECT MATH PERFORMANCE

Subjects	Baseline	Treatment
Fritz (Target)	.00	.62
Kim (Nontarget)	.00	.00
Amy (Target)	.04	.63
Rich (Nontarget)	.04	.00
Beth (Target)	.00	.60
Chris (Nontarget)	.00	.00

TABLE 2

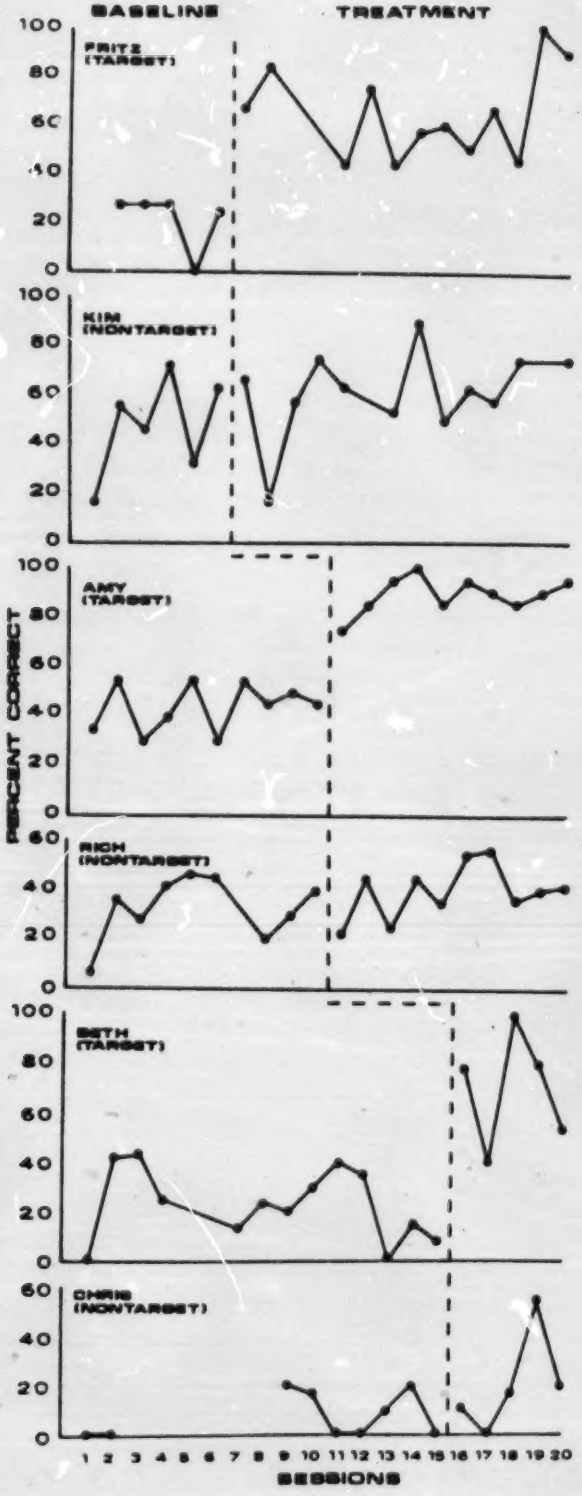
PROPORTION OF CHILDREN IN CLASS CHOOSING EACH SUBJECT ON SOCIOMETRIC RATINGS

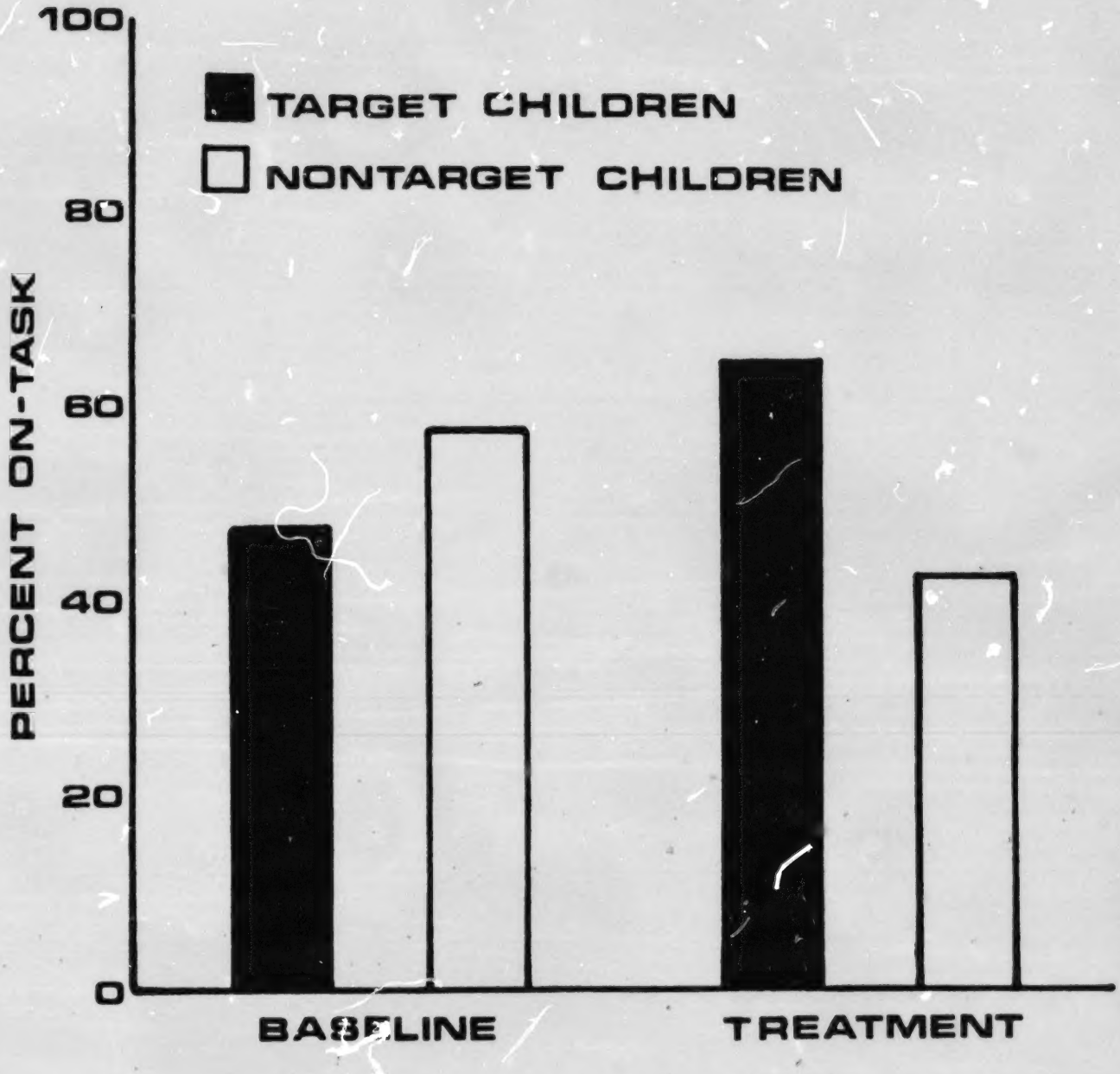
	Baseline		Treatment		
Subjects	Ratings				
	1	2	3	4	5
Fritz (Target)	.03	.04	.07	.02	.04
Kim (Nontarget)	.00	.00	.00	.03	.05
Amy (Target)	.02	.04	.02	.03	.00
Rich (Nontarget)	.02	.04	.03	.02	.00
Beth (Target)	.02	.00	.03	.03	.04
Chris (Nontarget)	.00	.00	.00	.02	.00

FIGURE CAPTIONS

Figure 1. Percent of correctly completed math problems.

Figure 2. Mean percent on-task for target and nontarget children.


BASELINE
TREATMENT
FRITZ (TARGET)
KIM (NONTARGET)
AMY (TARGET)
RICH (NONTARGET)
BETH (TARGET)
CHRIS (NONTARGET)
PERCENT CORRECT
SESSIONS
0
20
40
60
80
100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


100
80
60
40
20
0
PERCENT ON-TASK
TARGET CHILDREN
NONTARGET CHILDREN
BASELINE
TREATMENT

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